NANOMATERIALS

V

Design and hierarchical assemblies of nanomaterials (nanoparticles, carbon materials, molecules) towards energy, sensing, electronic, catalysis and detection applications

The fast growing research in nanoscale science and nanotechnology has brought many potential opportunities as well aschallenges in the fields of nanostructured materials and their incorporation into functional devices. The objective is to discuss innovative researches and recent developments in novel multifunctional nanomaterials for energy, sensing, electronic, catalysisand detection technologies. Such a symposium would be a good opportunity to bring together researchers from different communities (chemists, physicists and engineers) and see the latest developments in the synthesis and the processing of nanomaterials, as well as the properties resulting of their assembling in devices.

Scope:

Nanomaterials exhibit unique properties, by comparison with their bulk counterpart, mainly due to their high surface to volume ratio and to quantum size effects. Moreover self-assembled nanostructures showed remarkable collective properties, useful for engineering nanoarchitectures. Therefore in the field of nanotechnologies, nanomaterials rapidly appeared to be essential building blocks for the fabrication of new nanodevices for catalysis, spintronic, optical, magnetic and electronic applications.

Tailoring the properties of materials at the nanoscale offers thus the potential for improvement in device performance for broad applications across the entire range of human activity. Intensive research activities have been devoted to the synthesis of nanomaterials and to the characterization of their properties during the last years. The study of their collective properties when they are assembled in nanostructures has merged new or enhanced properties. The challenges for nanomaterials lie now in the design and tailoring of complex hybrid nanoparticles and 'intelligent' or 'smart' nanomaterials (nanotubes, functionalized surfaces, multi-layers, novel thin films and interfaces) with multiple functions and in their integration in devices. Among processing integration methods, hierarchical assembly arranges nanostructures at different length scales and becomes now an effective method of fabricating artificial metamaterials from composite nanostructures tailored for a particular response. With this in view, a considerable effort of research is developing this last decade to integrate multifunctional nanomaterials in devices through hierarchical assemblies approaches towards catalysis, spintronic, optical, magnetic and electronic applications.

The symposium will focus on state-of-the-art recent developments in the design of novel multifunctional nanomaterials based devices for energy, sensing, electronic, catalysis and biomedical technologies. The objective is to discuss innovative researches in the fields of nanostructured materials and their incorporation into functional devices. A special concern is also the design of the new devices and the study of their corresponding macroscopic properties. Such a symposium would be a good opportunity to bring together researchers from different communities (chemists, physicists and engineers) and see the latest developments in the synthesis and the processing of nanomaterials, as well as the properties resulting of their hierarchical assembling in devices.

Hot topics to be covered by the symposium:

- Synthesis of molecular and hybrid nanomaterials(nanoparticles, carbon nanotubes, graphene, molecules).
- Assembling strategies in hierarchically superstructures
- Processing methods towards nano-devices
- Intelligent soft matter systems
- Devices for energy storage (supercapacitors and batteries), catalysis, energy, sensing, electronic, catalysis and detection applications

List of invited speakers (confirmed) :

- Robert E. Cohen, MIT, Chemical Engineering, Cambridge, USA
- Cuong Pham Huu, CNRS-University of Strasbourg, France
- Paolo Morais, University of Brasilia, Brazil
- R. Ziolo, Research Centre for Applied Chemistry, CIQA, Mexico City, Mexico
- O. Azzaroni, INIFTA – CONICET – Universidad Nacional de La Plata, Argentina
- Andre-Jean Athias, Université Pierre et Marie Curie, France
- Kwang-Sup Lee, Department of Polymer Science & Engineering, Hannam University Seoul, Korea
- Benoit Pichon, IPCMS, CNRS-University of Strasbourg, France
- Nguyen T K Thanh, Nanomaterials Laboratory, University College of London, London, UK
- Bruno Chaudret, INSA Toulouse, France
- Michel Wong Chi Man, ENSCM, Montpellier, France
- Jinwoo Lee, Chemical engineering department, POSTECH, South Korea

START AT	SUBJECT	NUM.	ADD
16:30	Low Temperature Synthesized Vanadium Carbide Nanosheets as Highly Active HER Catalyst	**V.8.35**	★

Authors : Xiang peng, Paul K. Chu
Affiliations : Department of Physics and Materials Science, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China

Resume : Vanadium carbide (VC) is one of the promising precious-metal-free catalysts for the hydrogen evolution reaction (HER) which produces clean and renewable hydrogen as an alternative to fossil fuels. Hybridization between the V atoms and p-orbitals of the C atoms produces metallic properties and similar electronic and catalytic properties with the Pt-group metals. In this presentation, we report the design and fabrication of a hierarchical nanosheet structure comprising isolated vanadium carbide nanoparticles encapsulated in a highly conductive mesoporous graphitic carbon network (VC-NS). The unique structure has a large specific surface area and highly efficient HER activity. The VC-NS hierarchical nanosheet structure is synthesized by a hydrothermal reaction and subsequent low-temperature and environmently-friendly magnesium thermic reaction. The electrochemical performance of the VC-NS hierarchical nanosheets is evaluated electrochemically based on a three-electrode system. The results demonstrate that many nanoparticles with diameters of 10-30 nm are encapsulated in the graphitic carbon network forming a 2D hierarchical nanosheet structure with a large number of exposed active sites thereby providing fast electron transport paths and good electrical contact with the acitve sites to facilitate HER. The hierarchical VC-NS electrocatalyst shows an overpotential of only 98 mV at a current density of 10 mA cm-2 with a small Tafel slope of 56 mV dec-1. On account of the excellent durability, the overpotential shifts by only 10 mV after 10000 CV scans at a current density of 80 mA cm-2. The precious-metal-free electrocatalyst, which can be mass produced economically with less environmental impact than common precious-metal based electrocatalysts, delivers outstanding HER performance and has large potential in HER and related energy generation schemes.

START AT	SUBJECT	NUM.	ADD
16:30	Room-Temperature Switching Behavior in CNT/Hexadecane Composites	**V.8.36**	☆
16:30	Synthesis of magnetic iron oxide nanoneedles containing multi-metallic nanoparticles and their application	**V.8.37**	☆
16:30	Synthesis of Photoluminescent Organic-Inorganic Ureasil Nanoparticles for Imaging Applications	**V.8.38**	☆
16:30	Controllable synthesis and characteristics of mesoporous CoxN nanocubes for efficient oxygen evolution reaction	**V.8.39**	☆
16:30	Thin Films of Chained Carbon on Metal Substrate: Synthesis and Raman Characterization	**V.8.40**	☆
16:30	Spray-flame synthesis of nanoscale LaCoO3 perovskite catalyst	**V.8.41**	☆